PATENT ABSTRACTS OF JAPAN

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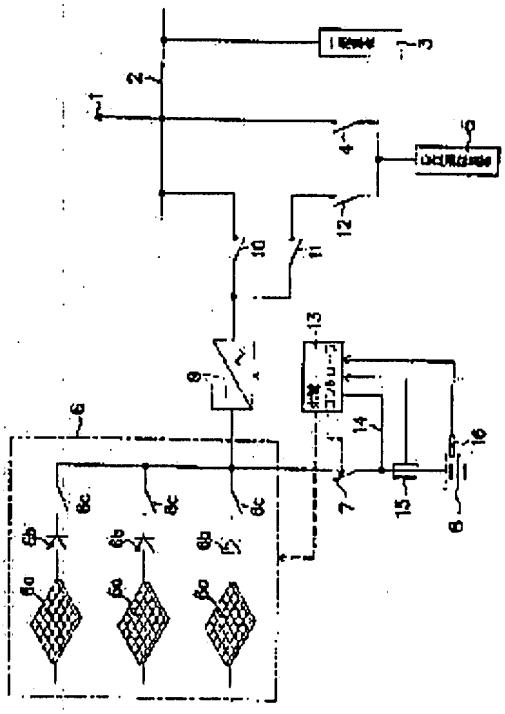
(54) DISTRIBUTED POWER SUPPLY

(57)Abstract:

PROBLEM TO BE SOLVED: To charge a battery without wasting the power even from the commercial power supply side through an AC/DC converter by providing means for charging a battery with the output from a generator, and means for controlling the power of AC/DC converter depending on the charged state.

SOLUTION: Under normal state of a commercial power supply system, an electromagnetic contactor 10 is turned on and electromagnetic contactors 4, 11, 12 are turned off. Consequently, the power generated from a generator is converted through a bi-directional DC/AC converter 9 into AC power which is fed through the electromagnetic contactor 10 to a low voltage bus 2 thus performing linked operation with commercial power supply. More specifically, a general load 3 is fed with power from a generator 6 and deficient power is supplemented from a commercial power supply when the power generation is insufficient due to insufficient sunshine. When a battery 8 is fully charged, a switch 7 is turned off under control of a charge controller 13 and the battery 8 is disconnected.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the distributed power unit which is made to carry out self-sustaining of the power plant at the time of the abnormalities of this commercial power network, and supplies power to the load for emergencies with a battery while carrying out link operation of the power plant using a solar battery etc. with a commercial power network.
[0002]
[Description of the Prior Art] In facilities, such as a hospital and a school, in order to attain energy saving, a distributed power unit may be used. A distributed power unit installs the power plant using a solar battery etc. in a facility, changes into an alternating current the direct current power generated with this power plant with an inverter (direct-current alternating current inverter), is made to link it with a commercial power network, and is supplied to the load in a facility (common load). And also when abnormalities, such as interruption of service, occur for a commercial power network according to disaster etc., self-sustaining of the power plant is carried out to this distributed power unit, and there is a thing changes the direct current power of this power plant into an alternating current with an inverter, and it enabled it to supply to the load for emergencies (self-sustaining load) in it. Moreover, in case it is this self-sustaining, a battery is put side by side to a power plant, and it enables it to supply power adequately in the power plant using a solar battery etc., since an output becomes unstable according to intensity of radiation etc.
[0003] If the amounts of generations of electrical energy of a power plant run short at Nighttime etc. at the time of the abnormalities of a commercial power network as for the above-mentioned distributed power unit, a battery will discharge. Moreover, a battery carries out self-discharge also to always [of a commercial power network / forward]. Therefore, when abnormalities next occur for a commercial power network, it has this distributed power unit, and while performing link operation with this commercial power network, it is necessary to charge a discharged part of a battery. And in the conventional distributed power unit, using the battery charger, the alternating current power of a commercial power network was once changed into the direct current, and this charge was performed by supplying a battery, controlling charge power.
[0004]
[Problem(s) to be Solved by the Invention] However, by the above-mentioned conventional charge approach, since the battery was supplied after once changing into the alternating current with the inverter the direct current power which the power plant generated and returning to the direct current again with the battery charger further, there was a problem that loss with an inverter or a battery charger became large, and charging efficiency worsened. And since it charged by changing the alternating current power of a commercial power network into a direct current with a battery charger when the amounts of generations of electrical energy of a power plant ran short, there was also a problem that the power of a commercial power network expensive for this charge had to be used. Furthermore, the battery charger of dedication was needed for charge of a battery, and there was also a problem of inviting the cost rise of a distributed power unit.
[0005] This invention is made in view of this situation, and by supplying the direct current power which the power plant generated to a direct battery, it aims at offering the distributed power unit which can be charged through a direct-current alternating current inverter also from a source-power-supply side while it can charge a battery, without producing the futility of power.
[0006]
[Means for Solving the Problem] Namely, the power plant which generates ** direct current power in order that this invention may solve the above-mentioned technical problem, Change into an alternating current the direct current power which this power plant generated, link with a commercial power network, and the battery put side by side to this power

plant and always [of a commercial power network / forward] are supplied at a common load. While having the function charged through a direct-current alternating current inverter also from a source-power-supply side In the distributed power unit equipped with the direct-current alternating current inverter which changes into an alternating current the direct current power outputted from these power plants and/or a battery, and is supplied to a self-sustaining load at the time of the abnormalities of a commercial power network A charge means to charge by connecting the output of a power plant to a battery at the time of the need in always [of a commercial power network / forward], It is characterized by establishing a means to operate a direct-current alternating current inverter as a battery charger, a charge detection means to detect the charge situation of this battery, and the output power control means that controls the bidirectional output power of a direct-current alternating current inverter according to the charge situation which this charge detection means detected.

[0007] ** According to the means, making always [of a commercial power network / forward] produce the futility of power by loss with an inverter or a battery charger, since a battery is charged by supplying the direct current power which the power plant generated to a direct battery is lost. However, since charge power like [at the time of using a battery charger] is uncontrollable by having connected the output of a power plant to the battery as it was, and sufficient charge power is not obtained, a battery is not charged completely or a possibility that charge power may become superfluous and the battery life of a battery may become short according to an overcurrent or overcharge arises. For this reason, according to the charge situation of the battery which the charge detection means detected, when an output power control means controls the output power of a direct-current alternating current inverter, charge power to a battery is indirectly controlled by the means of **. Therefore, since charge power is indirectly controlled by controlling the output power of a direct-current alternating current inverter rather than becoming controllable [charge power] and controlling moreover using the battery charger of dedication also when supplying the direct current power which the power plant generated to a direct battery, the futility which forms an expensive battery charger can also be excluded. In addition, since a commercial power network compensates a part for this fluctuation when output power is changed by control of a direct-current alternating current inverter in this way, for a common load, it is always stabilized and power can be supplied.

[0008] Moreover, the power plant which generates ** direct current power and the battery put side by side to this power plant, While having the function to change into an alternating current the direct current power which this power plant generated, to link with a commercial power network, to supply a common load, and to charge always [of a commercial power network / forward] through a direct-current alternating current inverter also from a source-power-supply side In the distributed power unit equipped with the direct-current alternating current inverter which changes into an alternating current the direct current power outputted from these power plants and/or a battery, and is supplied to a self-sustaining load at the time of the abnormalities of a commercial power network A charge detection means to detect the charge situation of a battery that charge is performed by the power supplied from a power plant at the time of the abnormalities of a commercial power network, It is characterized by establishing the generation-of-electrical-energy section means for switching which switches the parallel connection number or the series connection number of the generation-of-electrical-energy section in a power plant according to the charge situation which this charge detection means detected.

[0009] ** Since according to the means it becomes controllable [charge power] by the connection number of the generation-of-electrical-energy section also at the time of the abnormalities of a commercial power network in case the power which the power plant generated is supplied to a battery, a possibility [like] that the battery life of a battery may become short according to the excess of charge power disappears. At the time of the abnormalities of a commercial power network, since the output power of a direct-current alternating current inverter becomes settled according to the load-carrying capacity of a self-sustaining load, the output power of this direct-current alternating current inverter cannot be changed like the means of **. However, if the connection number of the generation-of-electrical-energy section is controlled and the generated output of a power plant is decreased like the means of **, only charge power can be decreased, supplying fixed power to a self-sustaining load.

[0010] Moreover, in the distributed power unit of ** or **, it is characterized by establishing a means to charge a battery from a direct-current alternating current inverter always [source-power-supply forward].

[0011]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing.

[0012] Drawing 1 and drawing 2 show 1 operation gestalt of this invention, and the circuit block diagram in which drawing 1 shows the configuration of a distributed power unit, and drawing 2 are the block diagrams showing the configuration of other power plants.

[0013] This operation gestalt explains the distributed power unit using a solar battery installed in facilities, such as a

hospital and a school. A commercial power network is drawn into the low voltage bus-bar 2 in a facility through the power receiving point 1. A commercial power network is supplied to the low voltage bus-bar 2 for example, by the 200V three phase 3 line type. While the common load 3 is connected, the self-sustaining load 5 is connected to the low voltage bus-bar 2 through magnetic contact 4. The common load 3 is a load usually used sometimes in this facility, and the self-sustaining load 5 is a load for emergencies used at the time of the abnormalities at the time of interruption of service of a commercial power network etc. In addition, this distribution line omits and shows the breaker for protection etc.

[0014] The power plant 6 is installed in the above-mentioned facility. A power plant 6 consists of two or more solar-battery array 6a, and the positive-electrode output of each solar-battery array 6a is connected in common through diode 6b and switch 6c, respectively, and it serves as a positive-electrode output of this power plant 6. By receiving light, each solar-battery array 6a makes a plane arrange many solar batteries which generate direct current power, and is installed in the location which sunlight, such as the outdoors and the roof, irradiates. The battery 8 is put side by side in this power plant 6 through the switch 7. And the positive-electrode output of this power plant 6 and the positive electrode of the battery 8 through a switch 7 are connected to the dc input of the bidirection direct-current alternating current inverter 9. The bidirection direct-current alternating current inverter 9 is a bidirection direct-current alternating current inverter of the quiescence mold using a semiconductor device which changes into the alternating current of 200V the direct current power which the power plant 6 generated, and the direct current power supplied from a battery 8. The ac output of this bidirection direct-current alternating current inverter 9 is connected to the above-mentioned self-sustaining load 5 through magnetic contact 11 and 12 while connecting with the above-mentioned low voltage bus-bar 2 through magnetic contact 10. In addition, ON/OFF is controlled by the relay which does not illustrate magnetic contact 4, 10, 11, and 12.

[0015] The charge controller 13 is formed in the above-mentioned distributed power unit. This charge controller 13 is the track 14 for electrical-potential-difference detection connected to the wiring on the street between a switch 7 and the positive electrode of a battery 8, and the shunt 15 (shunt) formed in this wiring on the street. While measuring the terminal voltage and the charge and discharge current of a battery 8, the temperature of this battery 8 can also be measured with the temperature sensor 16 formed in the battery 8. It is used in order that the terminal voltage of these batteries 8 and the measured value of the charging current may compute charge power, charge electric energy, and overcharge electric energy, and the measured value of the temperature of a battery 8 is used for computing the mean temperature while it acquires current temperature. Moreover, this charge controller 13 has integrated the time of this battery 8 while recording the career of a battery 8. And this charge controller 13 controls ON/OFF of each switch 6c of a power plant 6, and a switch 7 while controlling the output power of the above-mentioned bidirection direct-current alternating current inverter 9 based on these calculation values etc.

[0016] Actuation of the distributed power unit of the above-mentioned configuration is explained. Magnetic contact 10 is set to ON and magnetic contact 4, 11, and 12 is set to OFF always [of a commercial power network / forward]. Therefore, the direct current power which the power plant 6 generated is changed into an alternating current with the bidirection direct-current alternating current inverter 9, and is supplied to the low voltage bus-bar 2 through magnetic contact 10, and link operation with a commercial power network is performed by this. That is, when this generated output is insufficient since there is little intensity of radiation while the common load 3 receives supply of power from a power plant 6, it receives supply of the power of an insufficiency from a commercial power network. Moreover, when a battery 8 is a full charge, a switch 7 is turned OFF by control of the charge controller 13, and this battery 8 is separated. In addition, magnetic contact 4 is turned ON at the time of link operation with this commercial power network, and you may make it supply power to the self-sustaining load 5. Moreover, in night etc., the bidirection direct-current alternating current inverter 9 can be operated as a battery charger, and a battery 8 can also be charged.

[0017] At the time of the abnormalities of a commercial power network, magnetic contact 4 and 10 is set to OFF, and magnetic contact 11 and 12 is set to ON. Therefore, the direct current power which the power plant 6 generated is changed into an alternating current with the bidirection direct-current alternating current inverter 9, and is supplied to the self-sustaining load 5 through magnetic contact 11 and 12. Moreover, at the time of this self-sustaining, since a switch 7 is turned on by control of the charge controller 13, since there is little intensity of radiation, when the generated output of a power plant 6 is insufficient, the power of an insufficiency is supplied from a battery 8. In addition, at the time of this self-sustaining, some bidirection direct-current alternating current inverters 9 can be used, or the inverter of small capacity which is different in this bidirection direct-current alternating current inverter 9 can also be used for it.

[0018] When a commercial power network returns from the time of abnormalities to always [forward] here and the battery 8 is discharging, a switch 7 serves as ON by control of the charge controller 13, the generated output of a power plant 6 is supplied to this battery 8, and recovery charge is performed. And the charge controller 13 controls the output

power of an inverter 9 based on the charge power obtained by this while measuring the charging current, terminal voltage, temperature of a battery 8 at the time of this charge, etc. Here, if generated output of a power plant 6 is set to P1, charge power of a battery 8 is set to P2 and the output power of the bidirection direct-current alternating current inverter 9 is set to P3, the relation of P2=P1-P3 will be materialized among these. Moreover, the generated output P1 of a power plant 6 is always changed by change of intensity of radiation etc. Therefore, when the output power P3 of the bidirection direct-current alternating current inverter 9 is set constant, according to fluctuation of generated output P1, the charge power P2 of a battery 8 will also be changed. Then, the charge controller 13 enables it to maintain the charge power P2 at the constant value optimal for that battery 8 by controlling the output power P3 of the bidirection direct-current alternating current inverter 9 according to fluctuation of the generated energy P1 in this charge period. And when it is judged that the battery 8 reached the full charge by charge electric energy, a temperature rise, etc., a switch 7 is turned OFF and this battery 8 is separated.

[0019] Moreover, also after the battery 8 which became a full charge as mentioned above is separated, charge power decreases by self-discharge. Then, the charge controller 13 performs a supplementary current, maintaining the charge power P2 at constant value, when only time amount required in order to guess the electric energy lost by this self-discharge based on temperature, a career, a time of a battery 8, etc. and to charge this electric energy turns ON a switch 7 and controls the output power P3 of the bidirection direct-current alternating current inverter 9 like the above.

[0020] Therefore, since the distributed power unit of this operation gestalt charges always [of a commercial power network / forward] by supplying the direct current power which the power plant 6 generated to the direct battery 8, its futility of power decreases. And since the charge power of a battery 8 can be kept constant by controlling the output power of the bidirection direct-current alternating current inverter 9 in the case of this charge, also when the generated output of a power plant 6 is changed, the optimal charge power can be maintained. In addition, since a commercial power network compensates a part for this fluctuation even if it changes the output power of the bidirection direct-current alternating current inverter 9 in this way, for the common load 3, it is always stabilized, and power can be supplied.

[0021] At the time of the abnormalities of a commercial power network, if intensity of radiation is recovered and a power plant 6 can generate sufficient power after a battery 8 discharges, this generated output will be supplied to a battery 8, and charge will be performed. However, since the output power of the bidirection direct-current alternating current inverter 9 becomes settled by the load-carrying capacity of the self-sustaining load 5 even if it is going to decrease charge power, when the generated output of the case where a battery 8 is already a full charge, or a power plant 6 becomes excessive, this output power cannot be changed. Then, he is trying for the charge controller 13 to restrict the charge power of a battery 8 by controlling ON/OFF of each switch 6c of a power plant 6 according to fluctuation of the charge electric energy of a battery 8, or generated output at the time of the abnormalities of a commercial power network. That is, it controls to decrease charge power by turning OFF a part of switch 6c, separating a part of solar-battery array 6a, and decreasing the generated output of this power plant 6.

[0022] Therefore, the distributed power unit of this operation gestalt can restrict the charge power of a battery 8 by separating a part of solar-battery array 6a according to fluctuation of the generated output of the charge electric energy of a battery 8, or a power plant 6 at the time of the abnormalities of a commercial power network.

[0023] In addition, in the power plant 6 shown in drawing 1 , the connection number of solar-battery array 6a was changed by carrying out ON/OFF of the switch 6c linked to a serial to each solar-battery array 6a. However, also when it is made to short-circuit the output of each solar-battery array 6a through switch 6c, respectively as shown in drawing 2 , the connection number of solar-battery array 6a can be changed by carrying out ON/OFF of such switch 6c.

[0024]

[Effect of the Invention] According to the distributed power unit of this invention, a battery can be charged by supplying the direct current power which the power plant generated to a direct battery so that clearly from the above explanation. Therefore, producing the futility of power by loss with a bidirection direct-current alternating current inverter or a battery charger is lost. And since the charge power of a battery can be controlled without forming the battery charger of dedication, the cost rise of the equipment by the expensive battery charger can be avoided, and degradation of the battery by superfluous charge power can also be prevented.

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CLAIMS

[Claim(s)]
[Claim 1] The power plant which generates direct current power, and the battery put side by side to this power plant, While having the function to change into an alternating current the direct current power which this power plant generated, to link with a commercial power network, to supply a common load, and to charge always [of a commercial power network / forward] through a direct-current alternating current inverter also from a source-power-supply side In the distributed power unit equipped with the direct-current alternating current inverter which changes into an alternating current the direct current power outputted from these power plants and/or a battery, and is supplied to a self-sustaining load at the time of the abnormalities of a commercial power network A charge means to charge by connecting the output of a power plant to a battery at the time of the need in always [of a commercial power network / forward], A means to operate a direct-current alternating current inverter as a battery charger, and a charge detection means to detect the charge situation of this battery, The distributed power unit characterized by establishing the output power control means which controls the bidirectional output power of a direct-current alternating current inverter according to the charge situation which this charge detection means detected.
[Claim 2] The power plant which generates direct current power, and the battery put side by side to this power plant, While changing into an alternating current the direct current power which this power plant generated, linking with a commercial power network, supplying a common load and always [of a commercial power network / forward] having a battery charge function also from a source-power-supply side In the distributed power unit equipped with the direct-current alternating current inverter which changes into an alternating current the direct current power outputted from these power plants and/or a battery, and is supplied to a self-sustaining load at the time of the abnormalities of a commercial power network A charge detection means to detect the charge situation of a battery that charge is performed by the power supplied from a power plant at the time of the abnormalities of a commercial power network, The distributed power unit characterized by establishing the generation-of-electrical-energy section means for switching which switches the parallel connection number or the series connection number of the generation-of-electrical-energy section in a power plant according to the charge situation which this charge detection means detected.
[Claim 3] The 1st term of a claim characterized by forming a means to charge a battery from a direct-current alternating current inverter in always [source-power-supply forward], or a distributed power unit given in the 2nd term.

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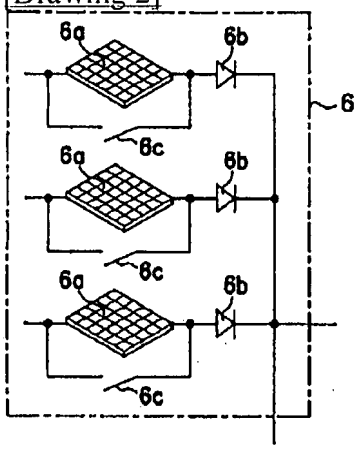
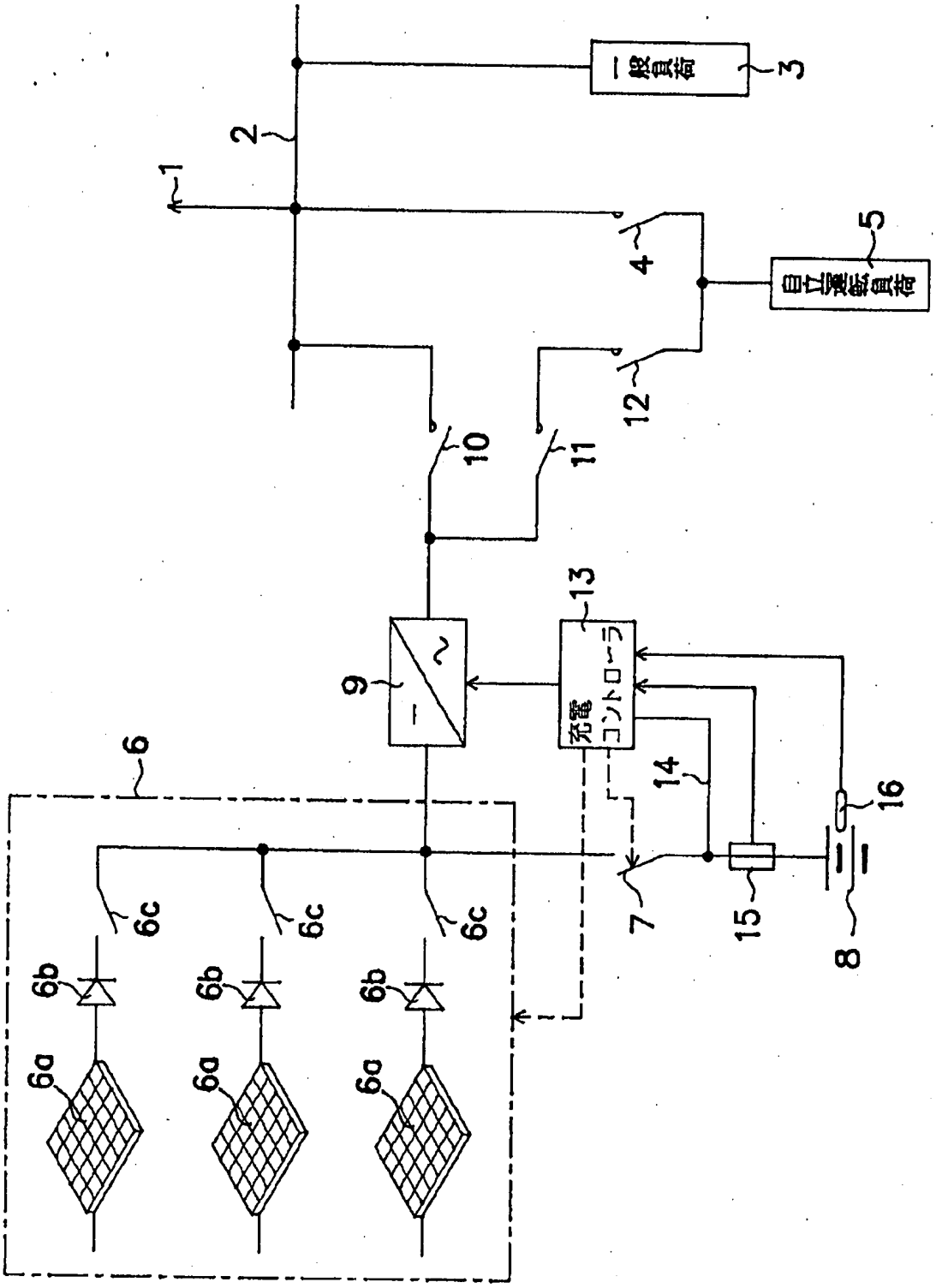
DRAWINGS

[Drawing 2]



[Drawing 1]



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Ｈ０２Ｊ	7/35			Ｈ０２Ｊ	7/35	Ｋ
Ｈ０１Ｍ	10/48			Ｈ０１Ｍ	10/48	Ｐ
Ｈ０２Ｊ	5/00		9470－5Ｇ	Ｈ０２Ｊ	5/00	
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審査請求　未請求　請求項の数３　ＦＤ　（全　６　頁）

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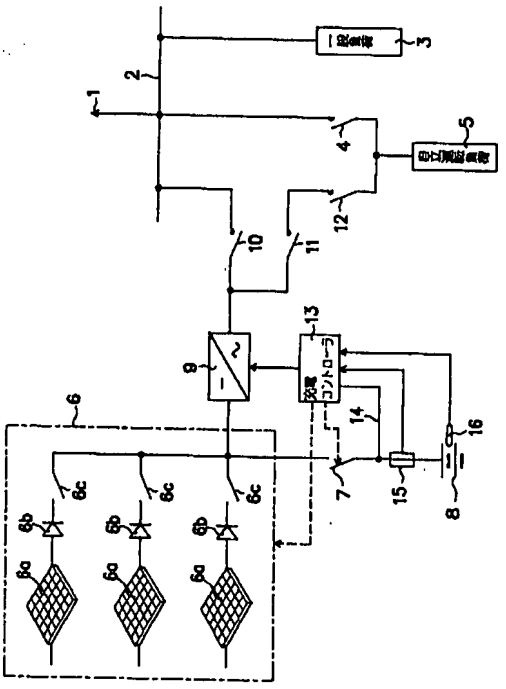
(54)【発明の名称】　分散形電源装置

(57)【要約】

【課題】　従来の分散形電源装置の蓄電池８への充電方法では、発電装置６が発電した直流電力を一旦双方向性直流交流変換装置９で交流に変換し、さらに充電器で再び直流に戻してから蓄電池に供給するので、双方向性直流交流変換装置９や充電器での損失が大きくなる。また、蓄電池８の充電のために専用の充電器が必要となる。そこでこのような問題を解決する分散形電源装置を提供する。

【解決手段】　充電コントローラ１３によって蓄電池８の充電状況を検出すると共に、この充電状況に応じて双方向性直流交流変換装置９の出力電力を制御することによって蓄電池８の充電電力を一定に保つ構成とする。



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【特許請求の範囲】

【請求項１】　直流電力を発電する発電装置と、この発電装置に併設される蓄電池と、商用電力系統の正常時に、この発電装置が発電した直流電力を交流に変換し商用電力系統と連系して一般負荷に供給し、商用電源側からも直流交流変換装置を介して充電する機能を有すると共に、商用電力系統の異常時に、これら発電装置及び／又は蓄電池から出力される直流電力を交流に変換して自立運転負荷に供給する直流交流変換装置とを備えた分散形電源装置において、

商用電力系統の正常時における必要時に、発電装置の出力を蓄電池に接続して充電を行う充電手段と、直流交流変換装置を充電器として動作させる手段と、この蓄電池の充電状況を検出する充電検出手段と、この充電検出手段が検出した充電状況に応じて、直流交流変換装置の双方向出力電力を制御する出力電力制御手段とが設けられたことを特徴とする分散形電源装置。

【請求項２】　直流電力を発電する発電装置と、この発電装置に併設される蓄電池と、商用電力系統の正常時に、この発電装置が発電した直流電力を交流に変換し商用電力系統と連系して一般負荷に供給し、商用電源側からも蓄電池充電機能を有すると共に、商用電力系統の異常時に、これら発電装置及び／又は蓄電池から出力される直流電力を交流に変換して自立運転負荷に供給する直流交流変換装置とを備えた分散形電源装置において、

商用電力系統の異常時に、発電装置から供給される電力によって充電が行われる蓄電池の充電状況を検出する充電検出手段と、この充電検出手段が検出した充電状況に応じて、発電装置における発電部の並列接続個数又は直列接続個数を切り換える発電部切換手段とが設けられたことを特徴とする分散形電源装置。

【請求項３】　商用電源正常時に直流交流変換装置から蓄電池を充電する手段が設けられることを特徴とする請求項第１項若しくは第２項記載の分散形電源装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、太陽電池等を利用した発電装置を商用電力系統と連系運転させると共に、この商用電力系統の異常時には発電装置を自立運転させ蓄電池と共に非常用の負荷に電力を供給する分散形電源装置に関する。

【０００２】

【従来の技術】病院や学校等の施設では、省エネルギー化を図るために分散形電源装置を用いる場合がある。分散形電源装置は、太陽電池等を利用した発電装置を施設内に設置し、この発電装置で発電した直流電力をインバータ（直流交流変換装置）で交流に変換し商用電力系統と連系させて施設内の負荷（一般負荷）に供給するものである。そして、この分散形電源装置には、災害等により商用電力系統に停電等の異常が発生したときにも、発電装置を自立運転させて、この発電装置の直流電力をインバータで交流に変換し非常用の負荷（自立運転負荷）に供給できるようにしたものがある。また、太陽電池等を用いた発電装置では日射量等に応じて出力が不安定となるため、この自立運転の際には、蓄電池を発電装置に併設して電力を安定供給できるようにする。

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【０００３】上記分散形電源装置は、商用電力系統の異常時には、夜間等に発電装置の発電量が不足すると蓄電池が放電される。また、商用電力系統の正常時にも蓄電池が自己放電する。従って、この分散形電源装置は、次に商用電力系統に異常が発生したときに備えて、この商用電力系統との連系運転を行う間に蓄電池の放電分を充電しておく必要がある。そして、従来の分散形電源装置では、充電器を用いて、商用電力系統の交流電力を一旦直流に変換し、充電電力を制御しながら蓄電池に供給することによりこの充電を行っていた。

【０００４】

【発明が解決しようとする課題】ところが、上記従来の充電方法では、発電装置が発電した直流電力を一旦インバータで交流に変換し、さらに充電器で再び直流に戻してから蓄電池に供給するので、インバータや充電器での損失が大きくなり、充電効率が悪くなるという問題があった。しかも、発電装置の発電量が不足する場合には、商用電力系統の交流電力を充電器で直流に変換して充電を行うので、この充電のために高価な商用電力系統の電力を使用しなければならないという問題もあった。さらに、蓄電池の充電のために専用の充電器が必要となり、分散形電源装置のコストアップを招来するという問題もあった。

【０００５】本発明は、かかる事情に鑑みてなされたものであり、発電装置が発電した直流電力を直接蓄電池に供給することにより、電力の無駄を生じさせることなく蓄電池の充電を行うことができると共に商用電源側からも直流交流変換装置を介して充電可能な分散形電源装置を提供することを目的としている。

【０００６】

【課題を解決するための手段】即ち、本発明は、上記課題を解決するために、①直流電力を発電する発電装置と、この発電装置に併設される蓄電池と、商用電力系統の正常時に、この発電装置が発電した直流電力を交流に変換し商用電力系統と連系して一般負荷に供給し、商用電源側からも直流交流変換装置を介して充電する機能を有すると共に、商用電力系統の異常時に、これら発電装置及び／又は蓄電池から出力される直流電力を交流に変換して自立運転負荷に供給する直流交流変換装置とを備えた分散形電源装置において、商用電力系統の正常時における必要時に、発電装置の出力を蓄電池に接続して充電を行う充電手段と、直流交流変換装置を充電器として動作させる手段と、この蓄電池の充電状況を検出する充電検出手段と、この充電検出手段が検出した充電状況に

応じて、直流交流変換装置の双方向出力電力を制御する出力電力制御手段とが設けられたことを特徴とする。

【0007】①の手段によれば、商用電力系統の正常時に、発電装置が発電した直流電力を直接蓄電池に供給することにより蓄電池の充電を行うので、インバータや充電器での損失により電力の無駄を生じさせることがなくなる。ただし、発電装置の出力をそのまま蓄電池に接続したのでは、充電器を用いた場合のような充電電力の制御を行うことができないので、十分な充電電力が得られないために蓄電池が完全に充電されなかったり、充電電力が過剰となり過電流や過充電により蓄電池の電池寿命が短くなるおそれが生じる。このため、①の手段では、充電検出手段が検出した蓄電池の充電状況に応じて、出力電力制御手段が直流交流変換装置の出力電力を制御することにより、間接的に蓄電池への充電電力の制御を行う。従って、発電装置が発電した直流電力を直接蓄電池に供給する場合にも充電電力の制御が可能となり、しかも、専用の充電器を用いて制御するのではなく、直流交流変換装置の出力電力を制御することにより間接的に充電電力を制御するので、高価な充電器を設ける無駄も省くことができる。なお、このように直流交流変換装置の制御により出力電力が変動した場合には、商用電力系統がこの変動分を補うので、一般負荷には常に安定して電力を供給することができる。

【0008】また、②直流電力を発電する発電装置と、この発電装置に併設される蓄電池と、商用電力系統の正常時に、この発電装置が発電した直流電力を交流に変換し商用電力系統と連系して一般負荷に供給し、商用電源側からも直流交流変換装置を介して充電する機能を有すると共に、商用電力系統の異常時に、これら発電装置及び／又は蓄電池から出力される直流電力を交流に変換して自立運転負荷に供給する直流交流変換装置とを備えた分散形電源装置において、商用電力系統の異常時に、発電装置から供給される電力によって充電が行われる蓄電池の充電状況を検出する充電検出手段と、この充電検出手段が検出した充電状況に応じて、発電装置における発電部の並列接続個数又は直列接続個数を切り換える発電部切換手段とが設けられたことを特徴とする。

【0009】②の手段によれば、商用電力系統の異常時にも、発電装置が発電した電力を蓄電池に供給する際に発電部の接続個数によって充電電力の制御が可能となるので、充電電力の過剰により蓄電池の電池寿命が短くなるようなおそれがなくなる。商用電力系統の異常時には、直流交流変換装置の出力電力は自立運転負荷の負荷容量に応じて定まるので、①の手段のようにこの直流交流変換装置の出力電力を変化させることができない。しかし、②の手段のように、発電部の接続個数を制御して発電装置の発電電力を減少させれば、自立運転負荷に一定の電力を供給しながら、充電電力のみを減少させることができる。

【0010】また、①或いは②の分散形電源装置において、商用電源正常時に直流交流変換装置から蓄電池を充電する手段が設けられることを特徴とする。

【0011】

【発明の実施の形態】以下、本発明の実施形態について図面を参照して説明する。

【0012】図1及び図2は本発明の一実施形態を示すものであって、図1は分散形電源装置の構成を示す回路ブロック図、図2は他の発電装置の構成を示すブロック図である。

【0013】本実施形態では、病院や学校等の施設に設置した、太陽電池を利用する分散形電源装置について説明する。商用電力系統は、受電点1を介して施設内の低圧母線2に引き入れられる。商用電力系統は、例えば200V三相3線式で低圧母線2に供給される。低圧母線2には、一般負荷3が接続されると共に、電磁接触器4を介して自立運転負荷5が接続されている。一般負荷3は、この施設内で通常時に使用される負荷であり、自立運転負荷5は、商用電力系統の停電時等の異常時に使用する非常用の負荷である。なお、この配電線では、保護用のしゃ断器等は省略して示している。

【0014】上記施設には発電装置6が設置されている。発電装置6は、複数の太陽電池アレイ6aからなり、各太陽電池アレイ6aの正極出力がそれぞれダイオード6bと開閉器6cを介して共通に接続されてこの発電装置6の正極出力となる。各太陽電池アレイ6aは、光を受光することにより直流電力を発電する太陽電池を平面状に多数配列させたものであり、野外や屋上等の太陽光が照射する場所に設置される。この発電装置6には、開閉器7を介して蓄電池8が併設されている。そして、この発電装置6の正極出力と開閉器7を介した蓄電池8の正極とが双方向性直流交流変換装置9の直流入力に接続されている。双方向性直流交流変換装置9は、発電装置6が発電した直流電力や蓄電池8から供給される直流電力を200Vの交流に変換する、半導体素子を利用した静止型の双方向性直流交流変換装置である。この双方向性直流交流変換装置9の交流出力は、電磁接触器10を介して上記低圧母線2に接続されると共に、電磁接触器11，12を介して上記自立運転負荷5に接続されている。なお、電磁接触器4，10，11，12は、図示しない継電器によってON／OFFが制御されるようになっている。

【0015】上記分散形電源装置には充電コントローラ13が設けられている。この充電コントローラ13は、開閉器7と蓄電池8の正極との間の配線路上に接続された電圧検出用線路14と、この配線路上に設けられた分流器15(shunt)によって、蓄電池8の端子電圧と充放電電流を測定すると共に、蓄電池8に設けられた温度センサ16によってこの蓄電池8の温度も測定できるようになっている。これら蓄電池8の端子電圧と充電電流の

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測定値は、充電電力と充電電力量と過充電電力量を算出するために用いられ、蓄電池８の温度の測定値は、現在の温度を得ると共に平均温度を算出するのに用いられる。また、この充電コントローラ１３は、蓄電池８の来歴を記録すると共に、この蓄電池８の使用時間を積算している。そして、この充電コントローラ１３は、これらの算出値等に基づいて、上記双方向性直流交流変換装置９の出力電力を制御すると共に、発電装置６の各開閉器６ｃと開閉器７のＯＮ／ＯＦＦを制御するようになっている。

【００１６】上記構成の分散形電源装置の動作を説明する。商用電力系統の正常時には、電磁接触器１０をＯＮとし、電磁接触器４，１１，１２をＯＦＦとする。従って、発電装置６が発電した直流電力は、双方向性直流交流変換装置９で交流に変換され電磁接触器１０を介して低圧母線２に供給され、これによって商用電力系統との連系運転が行われる。即ち、一般負荷３は、発電装置６から電力の供給を受けると共に、日射量が少ないためにこの発電電力が不足する場合に、商用電力系統から不足分の電力の供給を受ける。また、蓄電池８が満充電の場合には、充電コントローラ１３の制御により開閉器７がＯＦＦにされてこの蓄電池８は切り離される。なお、この商用電力系統との連系運転時に電磁接触器４をＯＮにして、自立運転負荷５に電力を供給するようにしてもよい。また、夜間などにおいて双方向性直流交流変換装置９を充電器として動作させ蓄電池８を充電することもできる。

【００１７】商用電力系統の異常時には、電磁接触器４，１０をＯＦＦとし、電磁接触器１１，１２をＯＮとする。従って、発電装置６が発電した直流電力は、双方向性直流交流変換装置９で交流に変換され電磁接触器１１，１２を介して自立運転負荷５に供給される。また、この自立運転時には、充電コントローラ１３の制御により開閉器７がＯＮになるので、日射量が少ないために発電装置６の発電電力が不足する場合に、蓄電池８から不足分の電力が供給される。なお、この自立運転時には、双方向性直流交流変換装置９の一部のみを使用したり、この双方向性直流交流変換装置９とは異なる小容量のインバータを用いることもできる。

【００１８】ここで商用電力系統が異常時から正常時に戻ったときに蓄電池８が放電している場合には、充電コントローラ１３の制御により開閉器７がＯＮとなって、発電装置６の発電電力がこの蓄電池８に供給され回復充電が行われる。そして、充電コントローラ１３は、この充電時における蓄電池８の充電電流や端子電圧及び温度等を測定すると共に、これによって得た充電電力等に基づいてインバータ９の出力電力を制御する。ここで、発電装置６の発電電力をP1とし、蓄電池８の充電電力をP2とし、双方向性直流交流変換装置９の出力電力をP3とすると、これらの間には

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Ｐ２＝Ｐ１－Ｐ３

の関係が成立する。また、発電装置６の発電電力Ｐ１は、日射量の変化等により常に変動している。従って、双方向性直流交流変換装置９の出力電力Ｐ３を一定とすると、発電電力Ｐ１の変動に応じて蓄電池８の充電電力Ｐ２も変動することになる。そこで、充電コントローラ１３は、この充電期間中の発電電力量Ｐ１の変動に応じて双方向性直流交流変換装置９の出力電力Ｐ３を制御することにより、充電電力Ｐ２をその蓄電池８にとって最適な一定値に保ち得るようにする。そして、充電電力量や温度上昇等により蓄電池８が満充電に達したと判断した場合には、開閉器７をＯＦＦにしてこの蓄電池８を切り離す。

【００１９】また、上記のようにして満充電になった蓄電池８は、切り離された後にも自己放電により充電電力が減少する。そこで、充電コントローラ１３は、蓄電池８の温度や来歴及び使用時間等に基づいてこの自己放電によって失った電力量を推測し、この電力量を充電するために必要な時間だけ開閉器７をＯＮにして、上記と同様に双方向性直流交流変換装置９の出力電力Ｐ３を制御することにより、充電電力Ｐ２を一定値に保ちながら補充電を行う。

【００２０】従って、本実施形態の分散形電源装置は、商用電力系統の正常時に、発電装置６が発電した直流電力を直接蓄電池８に供給して充電を行うので、電力の無駄が少なくなる。しかも、この充電の際には、双方向性直流交流変換装置９の出力電力を制御することにより、蓄電池８の充電電力を一定に保つことができるので、発電装置６の発電電力が変動した場合にも最適な充電電力を維持することができる。なお、このように双方向性直流交流変換装置９の出力電力が変動しても、商用電力系統がこの変動分を補うので、一般負荷３には常に安定して電力を供給することができる。

【００２１】商用電力系統の異常時には、蓄電池８が放電された後に日射量が回復して発電装置６が十分な電力を発電できるようになると、この発電電力が蓄電池８に供給されて充電が行われる。しかし、蓄電池８が既に満充電の場合や発電装置６の発電電力が過大になった場合に充電電力を減少させようとしても、双方向性直流交流変換装置９の出力電力は自立運転負荷５の負荷容量によって定まるので、この出力電力を変化させることはできない。そこで、充電コントローラ１３は、商用電力系統の異常時には、蓄電池８の充電電力量や発電電力の変動に応じて発電装置６の各開閉器６ｃのＯＮ／ＯＦＦを制御することにより、蓄電池８の充電電力を制限するようにしている。即ち、開閉器６ｃの一部をＯＦＦにし太陽電池アレイ６ａの一部を切り離してこの発電装置６の発電電力を減少させることにより、充電電力も減少させるように制御する。

【００２２】従って、本実施形態の分散形電源装置は、

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商用電力系統の異常時に、蓄電池8の充電電力量や発電装置6の発電電力の変動に応じて太陽電池アレイ6aの一部を切り離すことにより、蓄電池8の充電電力を制限することができる。

【0023】なお、図1に示した発電装置6では、各太陽電池アレイ6aに直列に接続した開閉器6cをON／OFFすることにより太陽電池アレイ6aの接続個数を変化させていた。しかし、図2に示すように、各太陽電池アレイ6aの出力をそれぞれ開閉器6cを介して短絡するようにした場合にも、これらの開閉器6cをON／OFFすることにより太陽電池アレイ6aの接続個数を変化させることができる。

【0024】

【発明の効果】以上の説明から明らかなように、本発明の分散形電源装置によれば、発電装置が発電した直流電力を直接蓄電池に供給することにより蓄電池の充電を行うことができる。従って、双方向性直流交流変換装置や充電器での損失により電力の無駄を生じさせることがなくなる。しかも、専用の充電器を設けることなく、蓄電池の充電電力を制御できるので、高価な充電器による装置のコストアップを回避して、過剰な充電電力による蓄電池の劣化も防止することができる。

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【図面の簡単な説明】

【図1】本発明の一実施形態を示すものであって、分散形電源装置の構成を示す回路ブロック図である。

【図2】本発明の一実施形態を示すものであって、他の発電装置の構成を示すブロック図である。

【符号の説明】

1　商用電力系統の受電点
3　一般負荷
6　発電装置
6a　太陽電池アレイ
8　蓄電池
9　双方向性直流交流変換装置
13　充電コントローラ
14　検出用線路
15　分流器
16　温度センサ

【図2】